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Responses of individual fourth-grade children were monitored in daily 30-minute sessions for 10 consecutive school days. Individual subjects were used as their own controls. The child sat before a small table with a surface-mounted button and a wall-mounted screen upon which visual stimuli were rear-view projected, using a filmstrip projector with the frame advance controlled by the button press. A doorbell chime was used as an auditory reinforcement-contingency indicator. Discourse from a third-grade series of science books was photographed line by line, with each line constituting a 35mm filmstrip frame. Data for baseline performance with no reinforcement contingency, fixed-interval schedule performance, variable -interval schedule performance, and variable-ratio performance are reported. The effects of given schedules are observable on an intrasession and intersession basis via inspection of cumulative response records. The fixed-interval schedule resulted in highly stable reading rates; the other schedules resulted in steadily accelerating rates. The introduction of reading comprehension test contingencies reduced behavior extraneous to reading and resulted in improved comprehension performance. Other conclusions are suggested as a starting place for further investigation. The reading comprehension tests and references are appended. (Author/CM)

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REINFORCEMENT SCHEDULES IN PACING READING RATE

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Tempe, Arizona

December 1968

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The effects of various schedules of reinforcement upon free operant behavior are well-known. Work that began on an infra-human level (Ferster and Skinner, 1957) has been extended to studies with children (Long, Hammack, May, and Campbell, 1958; Long, 1962). The effects have been summarized and extended by speculation and analogy in educational psychology textbooks.

Few persons have questioned the applicability of the schedules of reinforcement technology to complex human behavior. Kendler's (1959) analysis of significant distinctions between the free operant context in which the data for the schedules of reinforcement literature was generated and the discriminated operant context characterizing instruction has been largely disregarded.

The present study is a broad-band probe of the effects of reinforcement schedules in the discriminated operant context termed "reading." Reading rate research has a long but unimpressive history (Berger, 1967). No systematic procedures have yet been identified to reliably produce adjustive reading skills. It would appear reasonable that reinforcement schedule technology may have promise in promoting such instructional outcomes.

Procedure

Design. The research used individual subjects as their own controls. Individual children were monitored in daily sessions of 30 minutes each over ten consecutive school days. The effects of given schedules are observable on an intra-session and inter-session basis via inspection of cumulative response records.

Subjects. Fourth grade pupils of the Arizona State University Campus Laboratory School participated in the study. Children were excused from their regular classroom and escorted by a research assistant to the University Classroom Learning Laboratory to participate in the study.

Apparatus. The experimentation was conducted in 8' x 8' enclosed sound attenuated cubicles. One cubicle was in a mobile van. A second was free-standing in the Laboratory facility. The child sat before a small table with a 3/4" diameter button surface mounted and a wall-mounted 18" x 18" mylar screen. Visual stimuli were rear-view projected using a Duquesne film-strip projector with the frame advance controlled by the button press. A Nutone doorbell chime was used as an auditory reinforcement-contingency indicator consistent with the reinforcement schedule under investigation. Button, projector, and chime were wired to standard electrical relay circuitry operant control equipment located in a separate room.

Reading material. Discourse from a third grade series of science books with which the children had had no previous experience was photographed line by line with each line constituting a 35mm film-strip frame. The print appeared as white on black when projected.

Baseline Performance

Six pupils were run with no reinforcement continency. At the beginning of the first session the child was shown how to advance the project or told to read the materials silently, and informed that his "turn" would be finished in about one-half hour.

Each pupil participated in five 30-minute sessions conducted over five consecutive days.

Figure 1 shows the performance of these subjects. The curves for the first two days for subjects 1 - 3 are elongated due to the gear ratio of the cumulative recorder. Missing data indicate absence from school.

The data indicate consistent intra-session rates and reasonably steady inter-session rates.

The over-all rate of subject B1 is steady. The marked increase in the sessions 8 - 10 suggests that the response button rather than verbal content assumed control of the rate. This was confirmed by observation of the subject with his head on the desk, tilting his chair back, and hitting the apparatus.

Although subject B2 was absent for three sessions, her rate was reasonably stable and she was observed to be attending regularly to the visual stimuli. The same holds for subject B3.

The somewhat grainy cumulative record of subject B4 indicates the uneven rate of responding during which the subject was observed engaged in extraneous behavior. Similar pauses are characteristic of the behavior of subject B5.

Subject B6 evidenced the highest overall response rate and appeared to consistently attend to the experimental task.

Fixed-Interval Schedule Performance

Six subjects were run on fixed-interval schedules; two subjects each at 10, 20, and 30 seconds. After the initial base rate session, subjects received the following directions:

"Sometimes when you push the button you'll hear a 'bong' like a doorbell. You get one point for each bong. Work to get as many

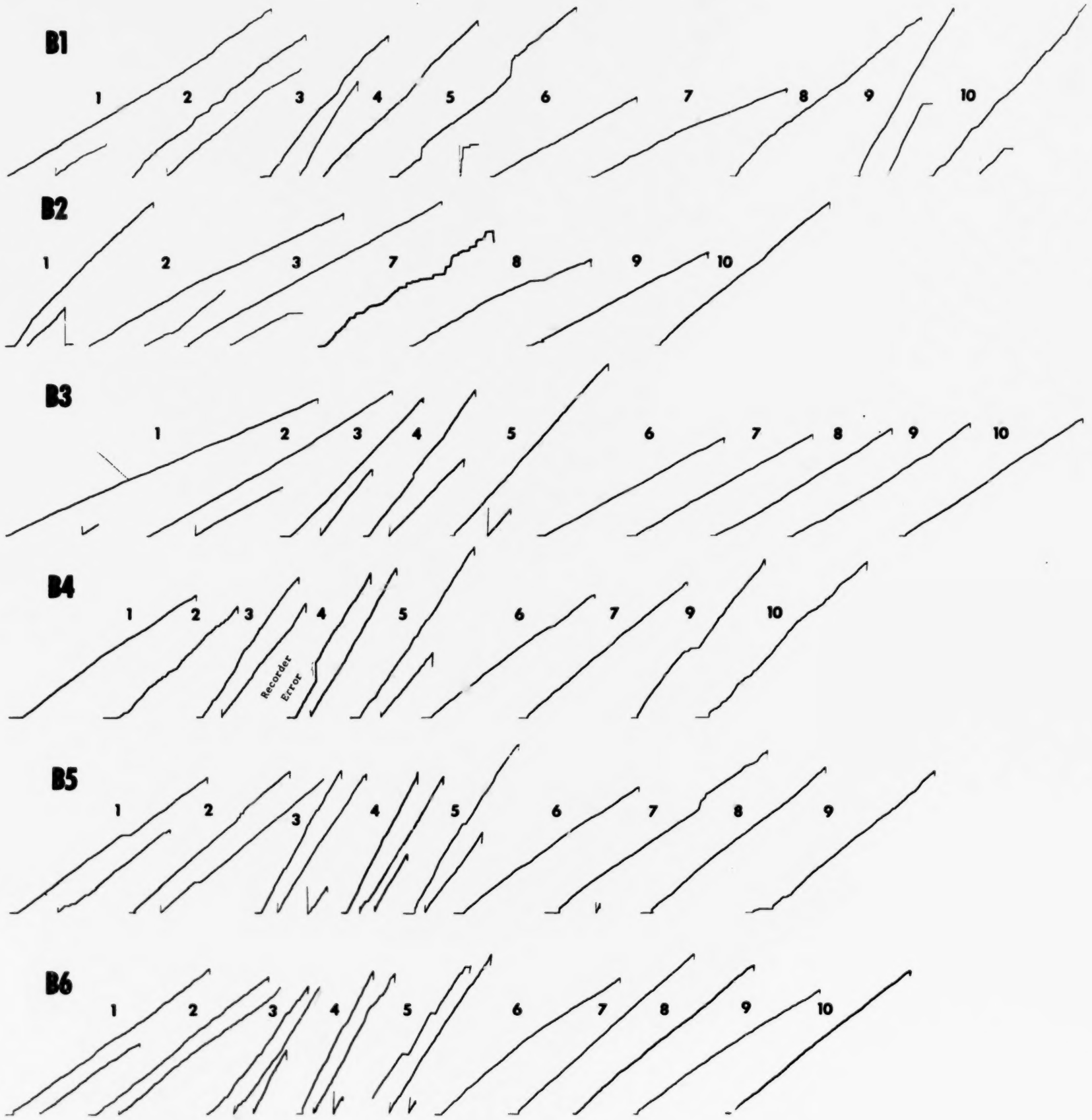

Figure 1 Baseline Performance

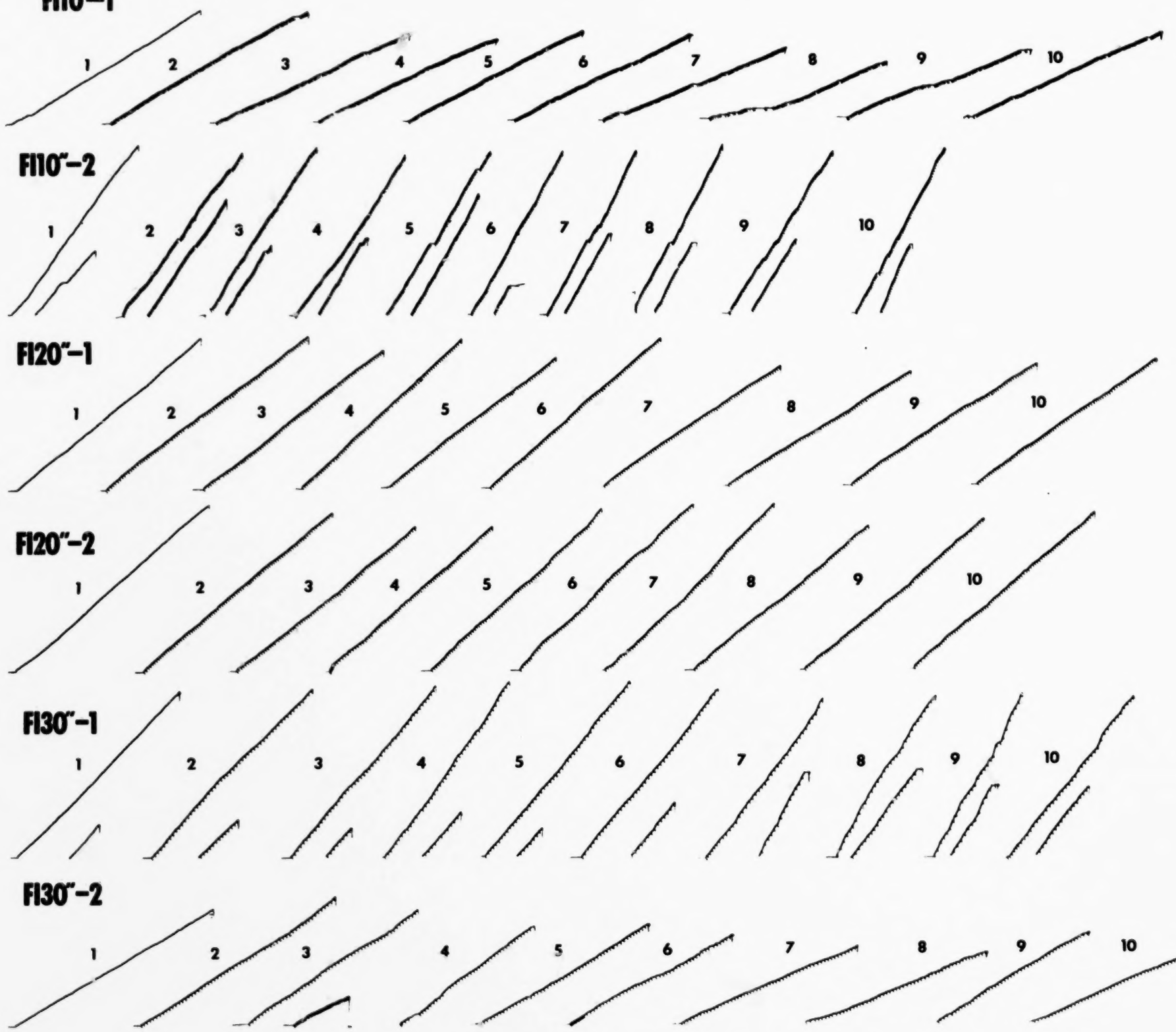

Figure 2 Fixed-Interval Performance

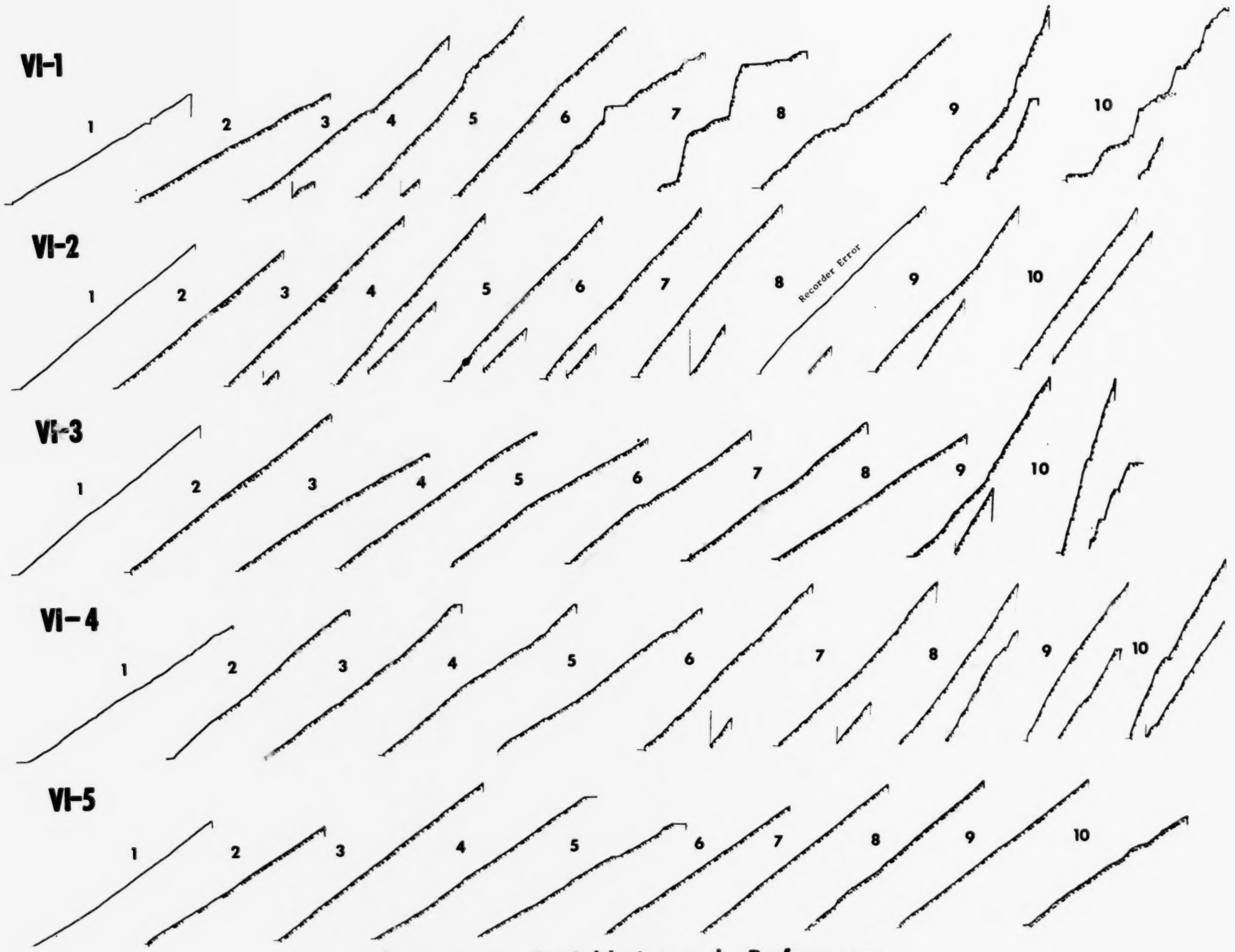

Figure 3 Variable-Interval Performance

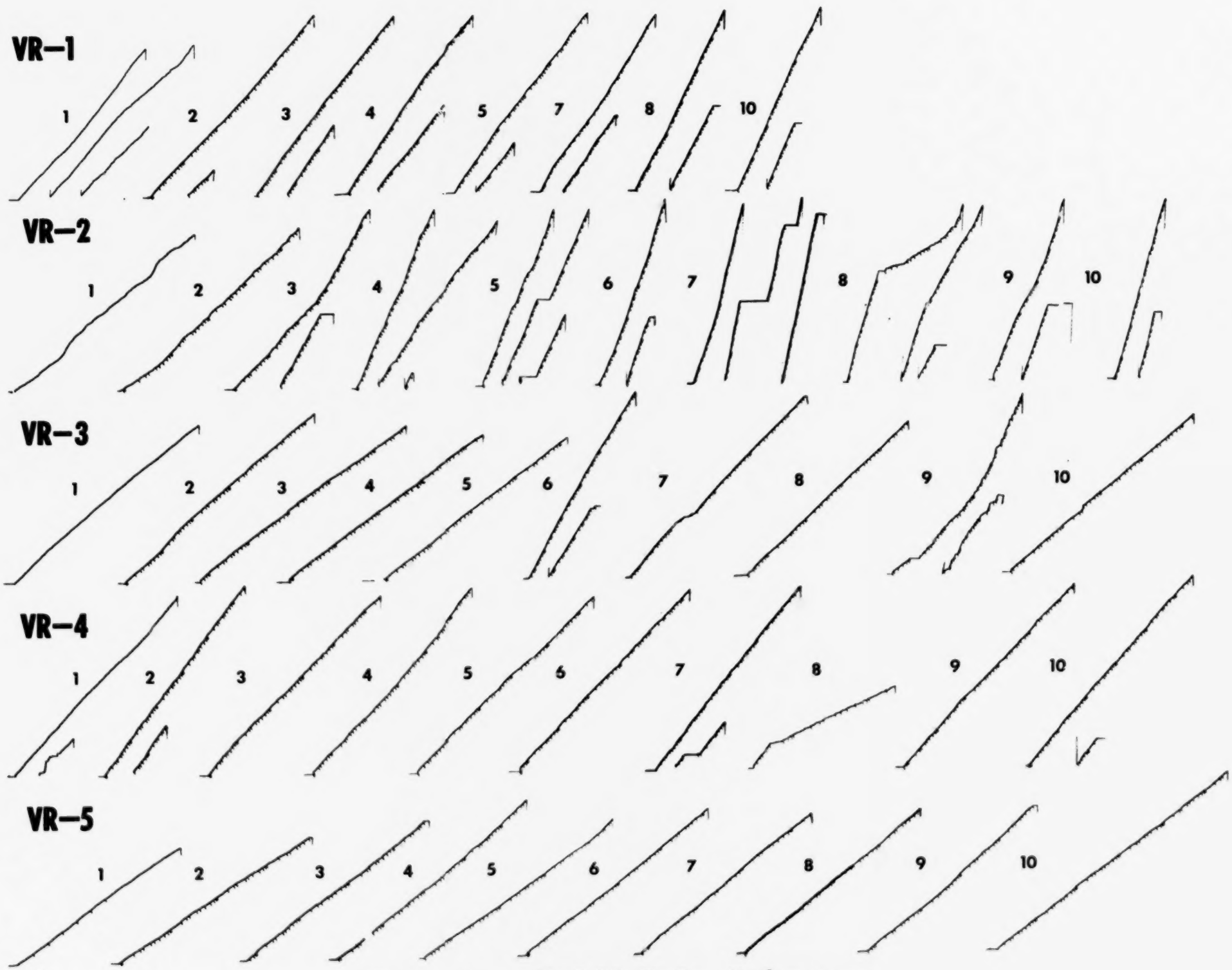

Figure 4 Variable-Ratio Performance

points as you can. You will get a prize in a few days at the end of your turn; the more points you have the better your prize will be. If anything goes wrong, tell us at once. Otherwise we will get you in about a half-hour when your time is up."

At the end of the tenth session, each child selected a prize from among $.10 - .35 items obtained from a variety store toy section.

Figure 2 presents the cumulative response curves for these subjects. The fixed-interval schedule generated extremely stable performance over sessions and within sessions. Inter-individual differences are clearly demonstrated. There appears to be no difference between the 10" - 30" range. Moreover the pauses after a reinforcement, typical of the fixed-interval schedule in a free-operant context, fail to occur. The chief effect of the FI schedule appears to be to stablize response rate over the duration of the experimental sessions.

Variable-Interval Performance

Five subjects were run under a variable-interval schedule of 20". The same instructions as were presented to the fixed-interval subjects were used. With the exception of subject 5, who did not appear to come under control, the VI schedule consistently generated an accelerated response rate. The acceleration however was accompanied by an observed increase in extraneous behavior; subjects were responding to the button rather than to the visual stimuli.

Variable-Ratio Performance

Five subjects were run under a variable-ratio schedule of 10 responses. The same instructions were used as with the FI and VI schedules.

As with the VI schedule, the VR schedule appears to accelerate overall response rate. However, for these five subjects the schedule leads to greater inter-session variability than did the VI schedule. Again, subjects were observed to be engaging in behavior other than looking at the screen.

Differential-Reinforcement-of-High-Rate Performance

Combined with Comprehension Test

The observations of behavior under the conditions described above suggested that some attention should be given to reading comprehension. Therefore multiple choice questions for each text were constructed (See Appendix A). Eight subjects were run for 10 sessions each. The first two sessions for each subject were under base rate conditions. The remaining eight sessions were divided into two sets of four. Under one of these conditions a DRH schedule was imposed.

Under the other condition the following instructions were used:

"After you finish reading today we are going to again give you a test to see how much you learned. The prize you get next week will depend upon how well you do on the test."

The order of the DRH and comprehension conditions was balanced for four subjects each. The summary results for each subject are tabulated below. The first and second columns indicates the session number and reinforcement contingency. The third column indicates the cumulative number of responses for the session. The fourth column shows the number of reinforcing stimuli attained in the session. The fifth and sixth columns show the percentage of correct responses to the comprehension questions. "Read %" applies to the questions relating to the text read by the subject. "Not read %" applies to the questions relating to later portions of the text which the subject did not read in the session.

Subject 1

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	288		92	22
2	Base	325		58	50
3	DRH 3"	354	108	64	26
4	DRH 5"	336	166	62	35
5	DRH 5"	355	187	47	33
6	DRH 5"	507	344	33	25
7	Comp.	339		44	52
8	Comp.	263		74	71
9	Comp.	266		58	66
10	Comp.	248		71	62

Subject 1 did respond to the DRH schedule. While his response rate decelerated when the schedule was withdrawn, comprehension also deteriorated.

Subject 2

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	563		73	50
2	Base	562		86	50
3	DRH 3"	893	808	86	-
4	DRH 3"	892	778	67	-
5	DRH 3"	827	708	69	50
6	DRH 3"	845	840	83	50
7	Comp.	703		93	67
8	Comp.	731		93	33
9	Comp.	625		92	25
10	Comp.	709		80	-

Subject 2 displays "ideal" performance. He had a consistent base rate, adapted immediately to the DRH, and reduced his rate somewhat under the comprehension condition while incrementing his text performance.

Subject 3

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	247		70	0
2	Base	232		86	0
3	DRH 5"	189	39	63	41
4	DRH 7.5"	190	60	83	50
5	DRH 7.5"	231	116	77	45
6	DRH 7.5"	200	38	83	44
7	Comp.	241		89	66
8	Comp.	235		100	53
9	Comp.	212		100	70
10	Comp.	229		100	63

Subject 3, in contrast, proved resistant to rate change. His comprehension, however, did increase consistent with instructions that reinforcement would depend upon test performance.

Subject 4

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	298		73	13
2	Base	314		91	26
3	DRH 5"	360	238	77	58
4	DRH 5"	418	337	69	36
5	DRH 5"	514	453	67	75
6	DRH 5"	549	480	86	75
7	Comp.	498		80	55
8	Comp.	453		85	55
9	Comp.	433		80	40
10	Comp.	512		86	66

Subject 4 displays a response pattern that replicates the data of Subject 2; he adapted readily to each change in the reinforcement contingency.

Subject 5

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	347		87	36
2	Base	359		85	65
3	Comp.	283		91	27
4	Comp.	240		88	81
5	Comp.	235		91	42
6	Comp.	227		85	59
7	DRH 5"	249	80	88	66
8	DRH 5"	277	83	92	58
9	DRH 5"	293	135	100	70
10	DRH 5"	366	98	93	46

Subjects 5 - 8 went from base rate, to comprehension, to DRH conditions. The behavior of Subject 5 is consistent with the reinforcement contingency. It is interesting that while the rate changes

for this subject are sensitive to the contingencies, comprehension remained high under each condition.

Subject 6

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	258		56	33
2	Base	244		86	44
3	Comp.	251		52	42
4	Comp.	237		77	29
5	Comp.	215		67	29
6	Comp.	149		80	50
7	DRH 5"	229	72	67	52
8	DRH 5"	216	83	80	20
9	DRH 5"	297	192	70	45
10	DRH 5"	316	230	50	62

Subject 6 displayed a consistently decreasing rate under the comprehension contingency. Rate consistently accelerated during DRH. His comprehension was highly variable from session to session under each condition.

Subject 7

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	351		75	7
2	Base	432		92	53
3	Comp.	338		46	59
4	Comp.	324		73	57
5	Comp.	346		68	35
6	Comp.	314		68	50
7	DRH 3"	477	164	55	20
8	DRH 3"	707	575	69	25
9	DRH 3"	816	760	57	27
10	DRH 3"	782	735	70	50

Subject 7 adapted his rate consistent with the reinforcement contingency. Under neither the comprehension nor the DRH condition, however, did the text performance match that attained under base rate.

Subject 8

Session	Schedule	Response	SR+	Read %	Not Read %
1	Base	198		71	21
2	Base	209		100	58
3	Comp.	242		55	42
4	Comp.	201		71	22
5	Comp.	201		77	19
6	Comp.	172		83	41
7	DRH 7.5"	204	70	100	44
8	DRH 7.5"	179	46	78	48
9	DRH 7.5"	173	61	71	64
10	DRH 7.5"	158	62	100	59

Subject 8 appears to have marched according to his own tune; his rate appears impervious to changes in experimental contingencies. His comprehension test performance exhibits considerable inter-session variability. However the differential performance on material read and not-read indicates that he was clearly attending to the text material.

Conclusions

The schedules and contingency combinations investigated barely scratch the surface of the reinforcement scheduling possibilities that might be explored. Several generalizations that appear to be supported by the results obtained in the study are worth listing as a starting place for further exploration.

1. While schedules of reinforcement do appear to affect reading response rate systematically, the relationship is highly sensitive to other situational conditions.

2. Unless experimental attention is given to comprehension monitoring, behavior extraneous to "reading" will compete with "reading" behavior; the discriminated operant will extinguish.

3. Fixed-interval, variable-interval, variable-ratio, and differential-reinforcement-of-high-rate schedules each have predictable effects. The fixed-interval schedule at the intervals studied resulted in highly stable reading rates, the other schedules resulted in steadily accelerating rates (Raygor, Wark, and Warren, 1966).

4. Subjects tended to exhibit high intra- and inter-session reliability in reading rates consistent with adaptation to schedule contingencies.

5. Inter-subject variability in reading rate and adaptation to schedule contingencies was evident, but not to the extent that it obscured reliable schedule effects.

6. The introduction of reading comprehension test contingencies reduced behavior extraneous to reading and resulted in improved comprehension performance.

7. Schedules of reinforcement technology is far from ready for instructional use in controlling reading rate. The effects of reinforcement schedules in an educational context appear far more complex than the simple relationships described in current textbook discussions of the subject. Sophisticated equipment requirements are generated by attempts to establish precise stimulus presentations. Development of this equipment will involve engineering work. Development and operational costs are likely to be prohibitive against cost-utility criteria. This is not to say that schedules of reinforcement may not prove useful devices when incorporated into more sophisticated general instructional systems than exemplified by current classroom practice. At present, however, schedules of reinforcement are best considered as something one reads about rather than something one uses to control reading rate.

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APPENDIX

READING COMPREHENSION TESTS

Animal Travels

1. During our winter the golden plover travels

   (a) south to South America (b) west to California (c) north to Alaska (d) east to New York

2. The champion traveler among birds is the

   (a) golden plover (b) swallow (c) Canadian goose (d) Arctic tern

3. Lemmings look like

   (a) dogs (b) rabbits (c) squirrels (d) rats

4. Lemmings eat only

   (a) plants (b) insects (c) tree bark (d) meat

5. Lemmings march in large numbers to

   (a) a large grove of trees (b) a river (c) the valley (d) the sea

6. The lemming is found in what countries?

   (a) France and Germany (b) Norway and Sweden (c) United States and Mexico (d) Italy and Spain

7. After the Atlantic salmon lays its eggs and covers them

   (a) the female stays with the eggs until they hatch (b) the male stays with the eggs until they hatch (c) both the male and female stay with the eggs until they hatch (d) the eggs are left by both parents

8. After the first two years of its life the Atlantic salmon moves

   (a) into warmer water (b) into colder water (c) to the ocean (d) from the stream to a lake

9. It is now believed that while salmon are in fresh water they eat

   (a) small water bugs (b) small fish (c) moss off of rocks (d) nothing

10. Sargasso is the name for a

    (a) European eel (b) kind of grass (c) young salmon (d) kind of sea weed

11. The European eel spends its life

    (a) in the ocean and in rivers (b) in the sea only (c) in rivers only (d) in lakes

12. The migration of the lemming is

    (a) periodic (b) sporadic (c) due to man (d) accidental

13. The migration of rabbits to Australia is

(a) periodic (b) accidental (c) due to man (d) normal

14. The most important kind of migration is

(a) periodic (b) accidental (c) normal (d) due to man

15. The most important thing about migration is that animals

(a) keep from freezing (b) keep from getting too hot (c) spread to new regions (d) multiply faster

16. Most animal migration that people talk about is

(a) periodic (b) due to man (c) normal (d) accidental

17. Most birds that migrate fly

(a) north in winter and south in summer (b) east in summer and south in winter (c) west in winter and north in summer (d) north in summer and south in winter

18. Bird travelers arrive at any one place

(a) always in the spring (b) at a different time each year (c) at the same time each year (d) always in the fall

19. As a rule, the smaller a bird is, the more likely it is to travel

(a) in the early afternoon (b) at any time of day (c) during the night (d) after 6 o'clock in the morning

20. One reason most birds migrate at night is because they can

(a) see better at night (b) fly better at night (c) sleep best in the daytime (d) find food best in the daytime

21. The fastest flying birds that we know are the

(a) robins and wrens (b) swallows and sparrows (c) warblers and vireos (d) duck hawks and swifts

22. In "bird banding" studies

(a) groups of flying birds are counted (b) bands are fastened on the legs of birds (c) birds are not allowed to migrate (d) birds are caught in wire cages

23. Only large birds can

(a) fly very close to the ground (b) fly to great heights (c) eat smaller birds only (d) not migrate

24. "Sense of direction" in birds has to do with

(a) instinct and learning (b) instinct (c) learning and vision (d) speed in flying

25. Many birds die during migration because they

(a) get too tired to fly (b) get lost (c) are killed by people (d) are killed by storms

26. Most of the birds in our part of the world

(a) do migrate (b) do not migrate (c) travel the same distances (d) live all their lives in one place

27. The number of important migration routes in North America is

(a) three (b) five (c) two (d) eight

28. The Great Lakes - Mississippi Valley route extends over

(a) mountains (b) deserts (c) flatlands (d) the sea

29. Birds migrate

(a) to find better surroundings for themselves (b) because they like to fly (c) to keep as warm as possible all year around (d) to keep from being killed in storms

30. The English sparrow and the starling

(a) came to our country by accident (b) were brought to our country purposely (c) have always been in our country (d) do not live in our country

Animals of Yesterday

1. The trees in the age of reptiles were

   (a) oak (b) elm (c) pine (d) maple

2. Dinosaur is another name for

   (a) reptile (b) terrible lizard (c) thunder lizard (d) huge animal

3. The brontosaurus had a

   (a) short neck (b) short tail (c) small body (d) small head

4. The brontosaurus did not eat grass because

   (a) it ate only meat (b) it did not like the taste of grass
   (c) there was no grass at that time (d) it could not chew grass

5. The diplodocus was the

   (a) longest animal that ever walked on land (b) heaviest animal that ever lived (c) tallest animal that ever lives (d) strongest animal that ever lived

6. Which reptile is the smallest but also the most fierce?

   (a) allosaurus (b) brontosaurus (c) flying lizard (d) diplodocus

7. The pterodactyl or "wing finger" has

   (a) feathers on its wings (b) no feet (c) wings made of skin
   (d) no wings

8. In the age of reptiles, reptiles lived

   (a) on land only (b) in the water only (c) on land and in water only (d) on land, in water, and in the air

9. Which of the following is a mammal?

   (a) brontosaurus (b) whale (c) diplodocus (d) pterodactyl

10. Why did the dinosaurs disappear?

    (a) their bodies were too large for their brains (b) they could not stand warm weather (c) they ate too much (d) they were killed by a great fire

11. The dinosaurs

    (a) took very good care of their eggs (b) laid their eggs in a nest made of sticks (c) went off and left their eggs (d) sat on their eggs

12. Petrified is a word meaning

(a) covered with resin (b) made of shell (c) bone (d) remade in stone

13. Which is a fossil?

(a) footprint of an animal of long ago (b) a rock that was buried for many years (c) sandstone covered by water during an earlier period (d) a stone used as a chair by a caveman

14. The first animals of the earth

(a) lived before reptiles (b) were reptiles (c) lived after reptiles (d) were mammals

15. What animal of today was the ancient trilobite related to?

(a) dog (b) lobster (c) cat (d) horse

16. The first living things to appear on land were

(a) plants (b) scorpions (c) animals (d) dinosaurs

17. The first animals to appear on land looked like our

(a) turtles (b) dogs (c) elephants (d) scorpions

18. Coal that we use today was at one time

(a) rock (b) sand (c) water (d) forest

19. Which of the following is an amphibian?

(a) fish (b) frog (c) lizard (d) snail

20. One of the early amphibians was a

(a) pterodactyl (b) stegosaurus (c) fish (d) eryops

21. The oldest bird known to scientists (the archaeopteryx) had

(a) a bill (b) no wings (c) no feet (d) teeth

22. The eohippus (dawn horse) was the same size as our

(a) fox (b) horse (c) elephant (d) cat

23. The eohippus lived in the

(a) mountains (b) desert (c) swamp (d) forest

24. Mastodons

(a) were covered with scales (b) looked like a bear (c) looked like our elephant (d) lived in a warm place

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25. About 50 years ago a Russian hunter found

(a) a live mammoth (b) a mammoth frozen in ice (c) the bones of a mammoth (d) the tusks of a mammoth

26. Man has survived while the dinosaurs of yesterday died out because the dinosaurs

(a) were very weak (b) had no food (c) had small brains (d) died of sickness

27. Many fossils are found

(a) in pools of water (b) in mud beds (c) on the top of the ground (d) in tar pools

28. Some of the best places for fossil hunting are

(a) where layers of rock are deep beneath the soil (b) on steep valley slopes (c) in places were many trees are found (d) in flat, soft soil like cornfields

29. Fossils are often taken to workrooms

(a) only when they are unbroken (b) after they have been carefully taken apart for shipping (c) in great blocks of rock (d) only when they are light enough to carry

30. Fossil bones are cleaned by

(a) washing them in water (b) chipping rock away from the fossil
(c) breaking up the bones and putting them back together
(d) rubbing them with a soft cloth

Animals We Know

1. The first animal to be tamed was the

   (a) cat (b) sheep (c) dog (d) monkey

2. In which way are cattle and dogs alike?

   (a) they both are tamed to be companions (b) they both eat the same kind of food (c) they have the same kind of feet (d) there are many kinds of cattle and many kinds of dogs

3. If an animal feeds its babies milk you can be sure it is a

   (a) cow (b) whale (c) mammal (d) insect

4. Which statement is not true of mammals?

   (a) they all lay eggs (b) they breathe with lungs (c) they have some hair (d) they are warm-blooded

5. Why do moles dig tunnels?

   (a) to find food (b) to lay eggs (c) to protect themselves (d) to sharpen their claws

6. The wings of a bat are made of

   (a) feathers (b) skin (c) fur (d) hair

7. Which statement about bats is true?

   (a) bats are blind (b) bats are mammals (c) bats harm people (d) bats make no sounds

8. Which sentence about monkeys is not true?

   (a) mother monkeys have several babies at the same time (b) most monkeys live in trees (c) monkeys are mammals (d) monkeys like a warm climate

9. Which is the biggest mammal?

   (a) lion (b) elephant (c) blue whale (d) camel

10. You can tell that a whale is a mammal because

    (a) it eats plants and small animals (b) it has a thick layer of fat under its skin (c) it is so big (d) it feeds its babies with milk

11. Polar bears are

    (a) very clumsy (b) good swimmers (c) likely to freeze in very cold weather (d) left alone as soon as they are born

12. When polar bears are born, they

(a) are as small as kittens (b) have very heavy fur coats (c) are left alone by their mothers (d) can stand very cold weather

13. The hump of a camel is

(a) for storing water (b) mostly fat (c) protection from the sun (d) protection from the sand

14. One reason the camel is called "ship of the desert" is that

(a) it drinks water so often (b) people often get "seasick" from riding camels (c) it can carry a person over 100 miles a day (d) its shaped like a ship

15. Camels are well suited for the desert because

(a) camel's hair makes excellent cloth (b) camels chew a cud like a cow (c) camels have thick pads on their feet (d) camels feed their babies milk

16. Which animal is a carnivore?

(a) dog (b) lion (c) giraffe (d) camel

17. Lions and cats are much alike because they both

(a) are about the same size (b) live only in hot lands (c) take care of their babies the same way (d) stalk giraffes for food

18. A male lion

(a) has a heavy mane of fur around his neck (b) prefers to kill people rather than zebras (c) has spots and stripes on his body (d) eats very little meat

19. The tallest animal in the world is the

(a) elephant (b) zebra (c) giraffe (d) whale

20. Which animal does not chew a cud?

(a) camel (b) giraffe (c) cow (d) lion

21. The worst enemy of the giraffe is the

(a) lion (b) elephant (c) hippopotamus (d) kangaroo

22. Hippopotamus means

(a) big horse (b) water buffalo (c) water horse (d) huge mammal

23. A hippopotamus eats

(a) plants (b) fish (c) small animals (d) insects

24. The male white-tailed deer

(a) has no antlers (b) is born with antlers (c) grows new antlers every spring (d) has horns

25. Which kind of food does an elephant eat?

(a) wild animals (b) fish (c) tree branches (d) grass and plant roots

26. About how long do elephants live?

(a) 40 years (b) 70 years (c) 100 years (d) 150 years

27. What makes the anteater different from most mammals?

(a) it has a tail (b) it has claws on its feet (c) it cannot run very fast (d) it has no teeth

28. Which animal is not a rodent?

(a) rabbit (b) anteater (c) chipmunk (d) mouse

29. How are gnawing mammals and people alike?

(a) they both can stand very cold weather (b) they both store up food for the winter (c) they both eat the same kinds of food (d) they both like to live in houses

30. Where would you go to see a kangaroo?

(a) India (b) China (c) Sweden (d) Australia

Fishes

1. The number of fins a goldfish has is

   (a) seven (b) four (c) six (d) five

2. Goldfish differ from humans because goldfish

   (a) do not need oxygen (b) do not breathe (c) will drown in air (d) do not need mouths to breathe

3. Many kinds of goldfish have come from

   (a) England and Scotland (b) Norway and Sweden (c) Italy and France (d) Japan and China

4. What kind of goldfish did the Chinese especially try to get?

   (a) queer (b) beautiful (c) very large (d) tiny

5. To be a fish an animal must have

   (a) a tail (b) a backbone (c) lungs (d) a neck

6. Some fish have a "swim-bladder" to help them

   (a) go up or down in the water (b) breathe (c) move quickly through the water (d) catch food

7. One fish that lives part of its life in fresh water and part in salt water is the

   (a) salmon (b) mackerel (c) trout (d) goldfish

8. Most ocean fish do not live deep down in the sea because

   (a) there is no feed there (b) the water pressure is too great (c) the water is too cold (d) there are dangerous enemies there

9. The spoonbill is one of the fishes that eats tiny

   (a) insects (b) shellfish (c) worms (d) plants

10. Fish are known to

    (a) be very greedy (b) eat very little food (c) break food in small bits (d) swallow only tiny parts of food

11. Some fishes have a keen sense of

    (a) sight (b) touch (c) hearing (d) smell

12. The cod fish lays

    (a) eggs called "mermaid's purses" (b) a few eggs (c) a great many eggs (d) eggs covered with hard cases

13. "Roe" is another name for

(a) fish eggs (b) egg cases (c) mermaid's purses (d) fish food

14. The paradise fish of Asia makes its nest of

(a) waterweeds (b) bubbles (c) seaweed (d) mud

15. Which fish is born alive instead of hatched from eggs laid in water?

(a) sun fish (b) bass (c) stickleback (d) guppy

16. Most fish are killed by

(a) enemies (b) old age (c) starvation (d) fishermen

17. Many fish eat their own young fish

(a) because there is a shortage of food (b) but no one knows why (c) because they taste so good (d) to keep down the number of fish

18. The bodies of most fish are

(a) spotted all over (b) darker above than below (c) darker below than above (d) the same color all over

19. Tiny plants and animals can kill fish by

(a) getting them tangled up (b) using weapons (c) causing disease (d) fighting with them

20. A baby eel looks like

(a) a tadpole (b) it is made of glass (c) a long snake (d) its body is black

21. When eels are young they travel to

(a) fresh water (b) salt water (c) warm water (d) cold water

22. To lay her eggs the female eel swims to

(a) a river (b) a creek (c) the lake (d) the sea

23. Salmon are hatched in

(a) the sea (b) large rivers (c) small streams (d) any water that flows rapidly

24. Herring are easy to catch because they

(a) live in small lakes (b) swim alone (c) swim in great schools (d) eat any kind of bait

25. One type of fish that reminds us of fish of long ago are

(a) herring (b) sturgeons (c) white fish (d) flounders

26. A good food fish which lives in salt water is the

(a) halibut (b) trout (c) yellow perch (d) white fish

27. The handsomest and best tasting fresh water fish is the

(a) tuna (b) trout (c) bass (d) smelt

28. The largest fish of today is the

(a) hammerhead shark (b) giant grouper (c) whale shark (d) large bass

29. One fish that can travel on land is the

(a) ocean sunfish (b) black swallowee (c) flying fish (d) climbing perch

30. A deep sea fish which never comes up to the surface while it is alive is the

(a) black bass (b) pale round mouth (c) shark sucker (d) head fish

Frogs and Toads

1. Male bullfrogs are different from female bullfrogs because the males have

   (a) longer hind legs (b) bright yellow throats (c) more bumps on their skin (d) bigger eyes

2. The eggs the mother bullfrog lays

   (a) a few in number (b) float on top of the water (c) are watched over by the father frog (d) do not grow until the tadpoles hatch

3. The tadpole breathes by

   (a) coming to the top of the pond for air (b) catching bubbles of air under the leaves of water plants (c) taking oxygen from water passing over its gills (d) getting oxygen through its breathing hole

4. The tadpole defends itself against enemies by

   (a) hiding among plants (b) sinking his suckers into them (c) changing to the color of his surroundings (d) biting with his beak-like mouth

5. In winter the tadpole

   (a) eats only enough to stay alive (b) needs no oxygen (c) freezes with the ice in the pond (d) burrows into the mud to sleep

6. What does the tadpole grow first?

   (a) hind legs (b) front legs (c) lungs (d) a big tongue

7. While the tadpoles mouth is changing he must

   (a) eat only soft, juicy things (b) live on food stored in his tail (c) get food from water passing over his gills (d) kill insects before eating them

8. A tadpole is like a frog because both

   (a) have long sticky tongues (b) eat insects (c) can swim (d) breathe air

9. The bullfrog sheds his skin

   (a) so he can eat it when food is scarce (b) only when he changes from a tadpole to a frog (c) when he grows too large for it (d) when the skin is injured by an enemy

10. Amphibian means

    (a) the same thing as pollywog (b) "without a tail" (c) "living in two places" (d) "living in water"

11. Cold blooded animals are

    (a) always cold (b) cold in water and warm on land (c) warm in water and cold on land (d) cold when their surroundings are cold

12. The frog is a good jumper because

    (a) his front legs balance him (b) his long strong hind legs push him (c) he can grab with his five toes (d) both his front legs and his hind legs are long and strong

13. Frogs are different from men because frogs have

    (a) no nostrils (b) ears behind their mouth (c) tongues fastened in front (d) no vocal cords

14. Frogs can live

    (a) only very short lives (b) as long as men do (c) about eight years at most (d) as much as thirty years

15. Toads and frogs have

    (a) very small scales (b) hairs you cannot see (c) completely bare skin (d) a velvety fuzz on their skin

16. Toads are different from frogs because toads

    (a) give off milky poison and frogs do not (b) have smooth skin and frogs do not (c) have smaller eyes than frogs (d) are slender and frogs are not

17. Most tadpoles live in

    (a) any water (b) salty water (c) deep water (d) shallow water

18. Most toads live in

    (a) shallow water where there are plants (b) warm, dry gardens and fields (c) the woods away from men (d) cool, damp places on land

19. Some frogs are called "flying frogs" because they

    (a) have lines on their back that look like wings (b) glide through the air on webbed feet (c) hitch a ride on the backs of birds (d) have feet that stick to branches

20. Sleeping through the winter without eating is called

    (a) amphibious life (b) burrowing (c) hibernating (d) slumbering

21. Grown up toads and frogs eat

    (a) water plants and animals (b) dead animals (c) live animals that are not moving (d) any small animal that moves

22. Frogs and toads swallow

(a) a little water with each bite of food (b) their food whole (c) the heads of small animals last (d) food after chewing it

23. The enemies of frogs and toads are

(a) a very few because they run and swim fast (b) land animals but not water animals (c) almost any animal except birds (d) often other frogs and toads

24. Frogs and toads sometimes protect themselves by

(a) pouncing on their enemies from behind (b) giving off a fluid that acts like a smoke screen (c) sitting very still (d) kicking their enemies with their strong legs

25. A toad's poison

(a) does not seem to hurt snakes (b) will make warts on a person's hands (c) is given off through glands in its mouth (d) will not harm animals as large as a dog

26. Most female frogs and toads lay their eggs in

(a) nests above pools (b) great numbers (c) strings which they wrap around their bodies (d) nests where the male cares for them

27. Frogs and toads do not like to

(a) hop in the rain (b) look at bright lights (c) swim in swift moving water (d) stay in one place

28. Frogs and toads help in gardens by

(a) eating harmful plants (b) eating harmful insects (c) becoming fertilizer when they die (d) digging the soil to make it loose and soft

29. Scientists use frogs for experiments because

(a) their bodies are a great deal like ours (b) they are easy to catch (c) they are less expensive than other animals (d) their bodies are left over after people eat the legs

30. Which animals are cousins of the frogs and toads?

(a) pollywogs (b) amphibians (c) lizards (d) salamanders

Plant and Animal Partnership

1. The partnership between ant and aphids is like the partnership between

   (a) farmer and ants (b) farmer and aphids (c) cow and ants (d) farmer and cows

2. The sweet liquid given off by aphids is called

   (a) milk (b) honeydew (c) cow food (d) ant milk

3. The ant cow that lives on corn plants is kept in the nest during

   (a) spring (b) summer (c) fall (d) winter

4. Insects which cause the destruction of houses and buildings are

   (a) termites (b) ants (c) beetles (d) ant cows

5. What do beetles that live in partnership with termites do?

   (a) take care of beetle eggs (b) take care of termite eggs (c) give off an oily liquid (d) drive off termite enemies

6. What does the termite get for taking care of the beetle?

   (a) protection (b) food (c) warmth (d) place to live

7. What happens when termites move to a new nest?

   (a) the beetles follow like a dog (b) the termites drive the beetles like cows (c) the termites and beetles travel side-by-side (d) the beetles lead the termites

8. The wood eaten by a wood-eating cockroach is digested by

   (a) protozoa inside the cockroach (b) other food the cockroach eats (c) the second stomach of the cockroach (d) plant juices drank by the cockroach

9. How do young cockroaches get their protozoa partners?

   (a) from the wood they eat (b) they are hatched with them (c) from older cockroaches shedding their skin (d) from their partnership with the beetles

10. Which insects do protozoa help to digest wood?

    (a) ants (b) termites (c) beetles (d) ant cows

11. How does the hermit crab protect himself?

    (a) by crawling deep into the mud (b) by swimming rapidly (c) by his own hard shell (d) by crawling into an empty snail shell

12. A partner of the hermit crab is

(a) the snail whose shell it uses (b) cockroaches (c) hedgehog hydroids (d) beetles

13. Another partner of the hermit crab is a

(a) sponge (b) snail (c) cockroach (d) aphid

14. How do hedgehog hydroids help crabs hide from enemies?

(a) the crabs hide behind them (b) the hydroids give off an inky liquid (c) the hydroids have stingers (d) the hydroids cover the floor of the sea

15. What does the sea anemone get from its partnership with the hermit crab?

(a) protection (b) warmth (c) more food (d) care for the young

16. Bacteria which remove nitrogen from the soil are

(a) small animals (b) small plants (c) minerals (d) fluids

17. One way that the farmer uses nitrogen in plants is

(a) by plowing under plants that have nitrogen (b) by using the plants to manufacture plant food (c) by harvesting the plants of the pea family (d) by changing and harvesting crops every year

18. What other plant lives in partnership with algae of lichen?

(a) bacteria (b) fungus (c) protozoa (d) wood

19. What color are algae?

(a) colorless (b) grayish (c) green (d) pink

20. What part does fungus have in the lichen partnership?

(a) furnishes food (b) gives off acid that eats into rock
(c) furnishes warmth (d) furnishes shade

21. Lichen help other plants by

(a) furnishing food (b) breaking down rock to form soil
(c) furnishing oxygen (d) furnishing nitrogen

22. Orchids help their fungus partners by furnishing

(a) food (b) warmth (c) carbon dioxide (d) water

23. Orchid seeds are interesting because

(a) of their strange colors (b) they are so small (c) they grow so fast (d) they grow under many conditions

24. What is the name of an orchid that grows wild in our country?

(a) sea flower (b) mocassin flower (c) violet (d) wild flower

25. What do parasol ants raise in their gardens?

(a) lichen (b) fungi (c) algae (d) orchids

26. What do ants do to ant gardens?

(a) bring in weeds (b) remove eggs (c) furnish sunlight (d) furnish green

27. The "plant animal" is green because he

(a) swallows little green plants (b) has nitrogen in him (c) has dye from the sea in him (d) swallows bacteria

28. What does the yucca moth get from carrying pollen to yucca plants?

(a) a safe place for its eggs (b) food from the pollen (c) protection from the other moths that it meets (d) a safe hiding place

29. Robins help cherry trees by

(a) pecking the soil (b) fertilizing the soil (c) pecking off dead leaves (d) scattering seeds

30. Green plants help all living things by

(a) making oxygen (b) making sugar (c) making carbon dioxide (d) making nitrogen

Reptiles

1. Which one is a reptile?

   (a) frog (b) tadpole (c) horned toad (d) true toad

2. All reptiles

   (a) breathe air (b) eat plants (c) have gills (d) begin their lives in water

3. All reptiles

   (a) have legs (b) are cold blooded (c) crawl (d) lay eggs

4. Reptiles have skin that is

   (a) slimy (b) dry (c) wet (d) warm

5. An alligator is different from a crocodile because an alligator

   (a) has a bigger, stronger tail (b) has more scales on his skin (c) is much longer (d) has a broader head

6. Alligators

   (a) breathe water (b) have loud voices (c) live in cold places (d) have no ears

7. Crocodiles and alligators

   (a) swim with their feet (b) breathe through their mouths (c) lay eggs in the water (d) eat nothing but meat

8. Baby alligators and crocodiles

   (a) are born in groups of three or four (b) eat small plants at first (c) are hatched from eggs (d) are about two feet long when born

9. The tuatara or "living fossil" is a

   (a) reptile (b) lizard (c) snake (d) turtle

10. The tuatara

    (a) has five legs (b) has three eyes (c) lives in trees (d) does not like birds

11. The chameleon is a lizard that changes color

    (a) when it gets excited (b) to match its surroundings (c) very slowly (d) when it sheds its skin

12. When the chameleon is free it eats

    (a) sugar and water (b) small water plants (c) small water animals (d) insects and dew

13. All lizards

(a) are small (b) have legs (c) have scales (d) lay eggs

14. You can tell a grass snake is not really a snake because it has

(a) four legs (b) eyelids (c) scales (d) no ears

15. Desert lizards

(a) can stand a great deal of heat (b) are always seeking moisture (c) usually hide during the day (d) are not really lizards at all

16. The gila monster usually

(a) kills people when it bites them (b) is harmless to people (c) kills many kinds of smaller animals (d) kills only other reptiles

17. Tortoise is another word for

(a) land turtle (b) hard shelled turtle (c) large turtle (d) green turtle

18. All turtles

(a) live in or near water (b) have sharp, strong jaws (c) eat only plants and berries (d) have shells of some kind

19. Soft shelled turtles

(a) cannot protect themselves (b) live in salt water (c) have sharp, strong jaws (d) grow to be the largest in the world

20. Turtles have

(a) teeth for chewing (b) teeth only for holding food (c) no teeth ever (d) no teeth except an egg tooth

21. In cold weather turtles

(a) grow heavier shells (b) bury themselves to escape the cold (c) stay in the sun as much as possible (d) huddle together in nests

22. Every year turtles' shells

(a) are replaced by new ones (b) get a new row of plates (c) grow larger plates (d) get a new leathery covering

23. Snakes move

(a) better on smooth ground than rough ground (b) on very small legs on their ribs (c) by gripping the ground with their scales (d) best when they sink into the sand a little

24. Snakes

(a) do not eat other snakes (b) eat plants (c) chew their food (d) use their tongues to feel things

25. Snakes must eat

(a) only meat and eggs (b) only animals they kill first (c) only small animals (d) every day

26. Some kinds of snakes protect themselves by

(a) putting their tails in their mouths and rolling (b) hiding in their mothers' mouths when they are little (c) slapping at enemies with their tails (d) rolling over and playing dead

27. During the winter large black snakes

(a) lay in the sun (b) stay together in a den (c) climb tall trees (d) bury themselves in mud

28. All snakes

(a) have scales on their skin (b) make their homes in holes in the ground (c) have rings around their bodies (d) have a white lining in their mouths

29. Which snake is helpful to the farmer?

(a) rattle snake (b) bull snake (c) copperhead (d) coral snake

30. Most poisonous snakes

(a) bit anyone near them (b) can poison themselves by accident (c) run away from people if they can (d) are not afraid of people

Sound

1. All sound is caused by

   (a) normally noisy objects (b) the movement of something
   (c) things people do (d) things at rest

2. Another name for what causes sound is

   (a) wavy lines (b) plucking (c) vibration (d) movability

3. Which of these is likely to be making a sound?

   (a) lightning moving the air it passes through (b) the roar of the sea in a conch shell (c) the leaves of a tree when there is no wind (d) a tuning fork lying on a table

4. Sound can travel

   (a) on the moon (b) from exploding stars (c) through empty space
   (d) through the air

5. A cheerleader at a football game uses a megaphone to

   (a) get sound to travel around corners (b) reflect sound waves
   (c) spread sound waves out (d) send sound waves in one direction

6. Which of these substances carries sound most slowly?

   (a) air (b) metal (c) wood (d) firm ground

7. Which travels fastest?

   (a) sound (b) a speeding train (c) an airplane flying (d) light

8. Which would travel fastest from New York to San Francisco?

   (a) electricity over a wire (b) a sound through air (c) a sound over a wire (d) light through water

9. An echo

   (a) cannot be heard more than once (b) improves a concert
   (c) is reflected sound wave (d) is only heard out of doors

10. How loud a sound anything makes depends on

    (a) what its pitch is (b) how far it moves when it vibrates
    (c) how fast it vibrates when plucked (d) how high or low it is

11. A sounding board makes a sound

    (a) off pitch (b) louder (c) softer (d) higher

12. Being off pitch means being

    (a) too loud or soft (b) noise rather than music (c) too high or low (d) out of tune

13. Which of these always has the same pitch?

(a) a single violin (b) all tuning forks (c) all violins
(d) a single tuning fork

14. The pitch of the sound produced by a rubber band depends on

(a) how big around it is (b) how long it is (c) how far it moves back and forth (d) all of the above

15. Noise is different from music because noise is

(a) always louder (b) caused by vibrations (c) off pitch
(d) irregular in vibration

16. A bell is like a tuning fork because

(a) the clapper can be made longer (b) it can produce many different notes (c) the whole bell vibrates when it rings (d) it isn't used for a musical instrument

17. Which is a wind instrument?

(a) chimes (b) saxaphone (c) drum (d) violin

18. A flute player produces many different notes by

(a) tightening pegs (b) changing the length of the column of air
(c) sliding the movable part back and forth (d) vibrating his lips

19. A piano has

(a) strings which each produce several notes (b) a hammer which moves over many strings (c) a hammer for every key and a string for every hammer (d) keys which cause strings to be plucked

20. A phonograph works in the same way as a

(a) dictaphone (b) telephone (c) projector (d) diaphragm

21. What vibrates to make the sound of your voice?

(a) the whole throat (b) the Adam's Apple (c) the whole voice box
(d) the vocal cords

22. What helps you make words out of sounds?

(a) nose and teeth (b) teeth and tongue (c) nose and tongue
(d) nose, teeth and tongue

23. The lion makes a sounding board out of

(a) his vocal cords (b) the ground (c) a large tree trunk
(d) his vocal sac

24. When parrots talk, they are only saying words they

(a) can use to talk to one another (b) know the meaning of (c) hear as sounds people make (d) hear other birds say

25. Animals other than men make themselves heard

(a) with voices or by moving parts of their bodies (b) only in a very small number of ways (c) only with voices rather as man does (d) only by moving their legs or tails

26. The most important part of the ear is

(a) inside your head (b) the part you see outside your head (c) the eustacian tube (d) completely boneless

27. Name three parts of the inner ear.

(a) the diaphragm, hammer, and cords (b) the anvil, waves, and eardrum (c) the hammer, anvil, and stirrup (d) the diaphragm, balance, and eardrum

28. The parts of our ear work in this order to bring us sound

(a) megaphone, vibrator, eustacian tube, nerve (b) outer ear, eardrum, inner ear, nerve (c) outer ear, inner ear, eardrum, nerve (d) eardrum, anvil, diaphragm, nerve

29. Having two ears is especially important

(a) in case one is injured (b) to use with two earphones (c) to tell from what direction a sound is coming (d) because our outer ears are so small

30. What part of the ear protects the eardrum?

(a) none, really, but chewing gum helps (b) the throat when you swallow (c) the anvil when you yawn (d) the eustacian tube when air pressure changes

Spiders

1. A garden spider

   (a) cannot bite people (b) can eat grasshoppers only if they are small (c) has poison that is not dangerous to people (d) is dangerous to people only if it bites them

2. A female spider usually

   (a) spends her time hunting food for her young (b) works for the male spider (c)dies after she lays her eggs (d) lives in the spot where she was born

3. Which of these spiders spins a web?

   (a) white crab spider (b) black widow spider (c) trap door spider (d) tarantula

4. Black widow spiders

   (a) have a bright red mark on their underside (b) are not really black all the time (c) always kill people when they bite (d) are about two inches long

5. Black widow spiders are usually found

   (a) where it is sunny and warm (b) in dark places near the ground (c) in bushes in the garden (d) where there is a lot of dampness

6. The most dangerous kind of spider in the United States is the

   (a) black widow (b) tarantula (c) white crab spider (d) jumping spider

7. Which of these spiders waits inside a flower for its dinner to come by?

   (a) tarantula (b) black widow spider (c) trap door spider (d) white crab spider

8. Which of these spiders pounces on insects from its nest?

   (a) jumping spider (b) wolf spider (c) trap door spider (d) white crab spider

9. Which spider is the largest?

   (a) black widow (b) wolf spider (c) tarantula (d) jumping spider

10. All spiders and insects have

    (a) simple eyes (b) bodies with only two parts (c) a hard covering on the outside of their bodies (d) two feelers

11. The hard covering on the spider's body

(a) is nature's way of helping the spider protect itself (b) doesn't change, since it would leave the spider unprotected (c) can let water through to keep the spider alive (d) cannot be bent or it will break

12. All spiders

(a) have spinnerets on their heads (b) have three jaws (c) have feelers or antennas (d) have the same number of legs

13. The spider's eyes

(a) are large ones made up of many small eyes (b) let him see for a long way (c) are all simple eyes (d) are six in number

14. A spider must eat

(a) only a very little at a time (b) every day or it will not live (c) only soft food that it can suck up (d) only very fresh food

15. Spiders are different from insects because spiders

(a) have no backbone (b) are larger (c) do not use a sense of touch (d) have no true jaws

16. Spiders breathe

(a) only air, unless they are fresh water spiders (b) through holes or slits in their body covering (c) through holes like noses in their heads (d) air, but not with lungs

17. The most different kinds of spiders live

(a) in the Far North (b) near the equator (c) near places with water (d) in people's houses

18. Spiders eat only

(a) insects smaller than themselves (b) other spiders (c) juices of living animals (d) bodies of insects they can poison

19. All spiders

(a) can spin webs (b) come from eggs (c) carry little spiders on their backs (d) can change color as they grow

20. Spiders protect their eggs by

(a) carrying them around with them (b) laying them in trees (c) putting them in spun silk sacs (d) staying near them to attack enemies

21. Spiders molt when

(a) a heavy rain soaks them (b) they haven't eaten for a while (c) they find a mate (d) they grow too large for their old skins

22. Which is a way that spiders do not travel?

(a) on a silk "balloon" (b) on spun webs from bush to bush (c) in things people are packing (d) on their wings when they are very young

23. What insect is a special enemy of the spider?

(a) the ant (b) the grasshopper (c) the wasp (d) the roach

24. What is one way spiders do not protect themselves?

(a) by curling up and playing dead (b) by killing plants to cover themselves (c) by biting their enemies (d) by dropping out of their webs

25. The first spiders on earth

(a) appeared millions of years ago (b) spun very large webs (c) are thought to have lived in dry trees (d) lived where there are people

26. If a spider loses a leg

(a) it dies (b) it can grow another (c) it can no longer spin webs (d) it can no longer climb

27. Spiders help us by

(a) spinning silk for cloth (b) killing harmful insects (c) spinning orb webs (d) killing weeds and other harmful plants

28. Which of these webs has no pattern?

(a) a cob web (b) a funnel web (c) a triangle web (d) an orb web

29. Man uses threads of spider silk

(a) in light bulbs (b) for stitches after operations (c) in telescopes (d) in small parts of automobiles

30. Which of these is a cousin to the spider?

(a) tarantula (b) velvet ant (c) wolf jumper (d) daddy long legs

Water

1. The air in the driest part of the world contains

   (a) water vapor (b) no water (c) liquid water (d) solid water

2. Water in the air is a

   (a) liquid (b) solid (c) crystal (d) gas

3. When liquid water changes to water vapor it

   (a) freezes (b) evaporates (c) condenses (d) melts

4. When water travels, it usually

   (a) keeps the same form (b) changes form once only (c) changes form often (d) changes form twice only

5. The first aqueduct was built by the people living in

   (a) Rome (b) Tyre (c) Athens (d) Naples

6. Some cities get their water from

   (a) wells (b) lakes (c) rivers (d) all of these

7. Los Angeles gets its water from

   (a) an aqueduct (b) a river (c) the ocean (d) a lake

8. The salt in sea water is

   (a) evaporated (b) at the bottom (c) floating on top (d) dissolved

9. The process of taking mud out of muddy water is called

   (a) brushing (b) sterilizing (c) cleansing (d) filtering

10. Chlorine is

    (a) clear water (b) used to take mud out of water (c) a poison (d) a filtering process

11. To get rid of germs, mud, and minerals in water you

    (a) distill it (b) add chlorine to it (c) boil it (d) boil and filter it

12. Through tiny holes in our skin, perspiration carries out

    (a) vitamins (b) heat (c) minerals only (d) waste materials

13. How many gallons of water do big cities use everyday?

    (a) a million (b) a billion (c) two billion (d) five hundred

14. To put out a fire water cools what is burning and

(a) does nothing else (b) shuts off air (c) produces special gas (d) removes burned material

15. A fire hydrant along the street works like a big

(a) tank (b) hose (c) faucet (d) pump

16. Water is put to work in parks through the use of

(a) hydrants (b) tanks (c) sprinklers (d) wells

17. As perspiration evaporates in your skin, it

(a) warms your skin (b) dries your skin (c) cools your skin (d) does nothing to your skin

18. Wind over large bodies of water keep the land near them

(a) cooler in summer and warmer in winter (b) cooler in winter and warmer in summer (c) warmer in winter and summer (d) cooler in winter and summer

19. Big iron boats float because they

(a) are lighter than water (b) are hollow (c) are pushed by motors (d) have wooden bottoms

20. Watering dry land so crops will grow on it is called

(a) fertilization (b) cultivation (c) flooding (d) irrigation

21. To form reservoirs for irrigation water, dams are built across

(a) ditches (b) lakes (c) rivers (d) all of the above

22. Green scum which covers part of a pond is called

(a) grass (b) algae (c) moss (d) seaweed

23. The biggest animal in the world is found in the

(a) swamp lands (b) desert (c) jungle (d) sea

24. A deep body of water freezes

(a) all the way through at the same time (b) on the bottom first (c) on the top first (d) in the middle first

25. Australia is cut off from other continents by

(a) rivers (b) oceans (c) lakes (d) forests

26. An Australian mammal which can fly is the

(a) duck bill (b) ostrich (c) fruit bat (d) emu

27. Oceans became like roads instead of like walls when man

(a) invented the compass (b) learned to make boats hollow
(c) invented motors for boats (c) invented the steamboat

28. Below Niagara Falls, water wheels drive big machines that

(a) fill buckets (b) generate electricity (c) filter water
(d) remove waste from water

29. Deltas are formed

(a) in the middle of rivers (b) along the ocean floor
(c) at the mouths of rivers (d) in deep lakes only

30. Glaciers

(a) cause floods when they melt (b) cause changes in the land as they move (c) are found mostly in valleys (d) are not found any more